

Watershed Based Plan Format

Name of Project: Pistol Creek Watershed Based Management Plan

Lead Organization: Blount County Soil Conservation District

Watershed Identification (name, location, 12-digit HUC, etc.):

Pistol Creek Watershed; Blount County, TN;

HUC-12:060102010107

Causes and Sources of Nonpoint Source Pollution in the Watershed

Pistol Creek, a tributary to the Little River, was classified as impaired due to *Escherichia coli* (*E. coli*) and loss of habitat due to siltation according to the Proposed Final Year 2016 303(d) List determined by the Tennessee Department of Environmental Conservation (TDEC). The Pistol Creek Watershed drains 25,021 acres within the Little River Basin and is a predominantly urban watershed with more than 50 % of the land area classified as either residential or commercial. Agricultural land use also plays an important role in this watershed with approximately 6,703 acres used for crop production or grazing. Elevated *E. coli* concentrations are associated with the leaching of human waste from more than 500 suspect systems that drain to Pistol Creek and its tributaries. Siltation issues are linked with upland and in stream erosion caused by both urban and agricultural activities that influence vegetation cover and soil health. The goal of the Pistol Creek Watershed Management plan is to identify and mitigate non-point source impairments to remove Pistol Creek from the 303(d) list.

E. coli

Dysfunctional septic systems are most likely the primary source of the pollutant *Escherichia coli* (*E. coli*) in the Pistol Creek Watershed. Of approximately 2,100 suspect septic systems within the greater Little River Basin, 541 suspect systems are located within the Pistol Creek Watershed. Many of the suspect systems are owned by low-income families that cannot afford to repair or replace their failing septic systems. Further, low-income communities likely do not have the information or the resources to assess their properties to ensure leach fields are functioning properly. A high percentage of urban land area also increases the risk of *E. coli* inputs from pet waste that is transported from yards and parks to surface waters. Further, with 46.1% agricultural land area, livestock-derived *E. coli* remains a prominent concern as an *E. coli* source within the Pistol Creek Watershed. Consequently, while priority will be given to addressing issues with dysfunctional septic systems, management strategies will also be developed and implemented to mitigate other sources of *E. coli* as needed.

Loss of Biological Integrity Due to Siltation

Siltation and loss of biological integrity in stream systems is linked to erosion, both upland and instream, and the transport of eroded sediments to surface waters. In the Pistol Creek Watershed, both urban and agricultural activities contribute to these issues.

In urban areas, impervious surfaces, such as roads and parking lots, impede water infiltration into the underlying soil during precipitation events. Precipitation runoff is directed to surface waters much more quickly resulting in sudden increases in the volume and velocity of stream flow. These pulses can cause severe in-stream erosion which removes viable habitat and increases sediment load in the stream. Further, pollutants that collect on impervious surfaces, such as oils, metals, fertilizers, and harmful chemicals, are washed away by stormwater and carried to nearby streams. According to the Tennessee Valley Authority (2003), streams 'impacted' between 10 to 25 % impervious cover have issues with increases in water temperature, stream channel instability, and food loss for important fauna. Pistol creek currently is currently estimated at 23 % imperviousness and is projected to reach 24 % by 2020. At 25% imperviousness, TVA suggests that the Creek would transition to a 'degraded' stream with very unstable stream channels, severe decreases in biodiversity, and significantly high pollutant loads that would threaten the health of downstream rivers and watersheds (including the Little River). Once 'degraded', even intensive stream restoration initiatives would only partially restore some aspects of stream quality. Although currently 'impacted', Pistol Creek has potential for many aspects of stream health and functionality to be improved and/or retained through restoration and conservation management. This Watershed Management Plan addresses many of these issues and incorporates proactive strategies to maintain the health and function of the Creek as Blount County continues to grow.

Agricultural activities also contribute significantly to habitat loss and siltation issues. In fact, according to the TVA, agricultural BMPs are considered the most cost effective short-term strategy to address non-point source pollution in the larger Little River Basin. Agricultural BMPs remain among the priority management strategies for mitigating non-point source pollutants. BMPs such as rotational grazing systems, livestock exclusion fencing, alternative watering sources, and riparian buffers have already been shown to be effective in reducing soil erosion from crop and pasture land and mitigating livestock waste, nutrient, and chemical transports to streams. These efforts will be continued and expanded throughout the full term of the Pistol Creek Watershed. Additional programs will be developed and implemented to continue land owner outreach and engagement in conservation agricultural practices and Federal and state programs, such as the Environmental Quality Incentives Program (EQIP).

Estimate of Load Reductions

The 2005 TDEC water quality goal states that concentration of the E.coli pathogen group shall not exceed a geometric mean of 126 cts/mL, where a geometric mean is the average of five or more samples within thirty days and cts is colony forming units. According to the 2005 Final TMDL report, the E. coli concentration in Pistol Creek exceeded this threshold at 398 cts/mL and a 71.6 % load reduction was prescribed. According to the TDEC 2006 Final TMDL report, the existing sediment load was 1,812 lb. per acre per year thus exceeding the target load of 397.1 lb. per acre per year. Accordingly, a load reduction of 1,414.9 lbs per acre per year (78.1 %) is required for stream health to be in good standing and delisted from the 303(d) impaired list. Sediments loads are directly affected by soil erosion in the Pistol Creek watershed, which is estimated at 5,631 tons of eroded soil per year. BMPs and initiatives in the Pistol Creek Watershed Management Plan are projected to reduce runoff sediment load by 4,467.7 tons per year, which would be a 79.3% sediment load reduction as a result of the twelve year management plan. *Note: A sediment load reduction of 772.7 tons per year (13.7 %) is projected by the end of Phase I (2021) as a result of management implementation supported by TN-NPS funds awarded in 2018.*

BMP List, Educational Activities and Budget

BMP List

Septic System Improvements

Dysfunctional septic systems are most likely the primary source of the pollutant *E. coli* in the Pistol creek watershed. Using low-elevation color infrared photography, 541 suspect septic systems have been identified. To address human-derived *E. coli* water quality issues, the most effective approach is to manage the source of the pollutant. This necessitates the repair or replacement of suspect septic systems and includes ensuring the appropriate design and functionality of leach fields. Many of the suspect septic systems in the Pistol Creek Watershed belong to low-income families who are financially unable to improve their systems. Consequently, a primary focus of the Pistol Creek Watershed Management Plan is to allocate funds for septic system improvements for low-income households. During the twelve year plan, two systems would be targeted during the first year and ten systems per year thereafter. The goal of this management plan would thus be to assist in the improvement of at least 112 suspect septic systems within a twelve year period. At a cost of \$4,000 per system, this initiative would cost a total of \$448,000.

Agricultural BMPs

Agricultural BMPs consist of a variety of management initiatives that mitigate soil erosion, enhance soil health, improve soil water infiltration, increase nutrient retention, and reduce stormwater and pollutant runoff. Agricultural BMPs implemented in this Watershed Management plan will target these issues in both crop and pasture land areas. In croplands, BMPs such as no tillage and the use of winter cover crops will be implemented to improve nutrient retention, soil quality, and water infiltration rates while maintaining viable crop yields. In pasture land areas, livestock exclusion fencing,

alternative watering systems, cross-fencing for prescribed grazing, stream crossings, high-use areas, and pasture/hay-land renovation establishment will be used to address issues of livestock degradation to upland and streambank areas which influences erosion, stream siltation, and habitat loss. The total cost for agricultural BMP initiatives will be \$381,826.

Constructed Wetlands

In recent decades, wetland construction has been increasingly used as a land management practice for flood control and for the mitigation of nutrient and erosion runoff in crop and pasture land. Conversion of natural low-lying areas prone to flooding to a constructed wetland offers an opportunity to utilize land area not suitable for agricultural or urban use and helps mitigate flooding in adjacent areas. Further, constructed wetlands serve as stormwater retention areas that are highly effective in filtering pollutant and sediments in runoff. The development and implementation of three constructed wetlands, at least one each in an urban and agricultural area, are planned. The cost for constructed wetland installation will be \$45,000.

Habitat Restoration

Streambank restoration in both urban and agricultural areas will be a priority throughout the twelve year management plan. A goal of restoring 4,000 linear feet of streambank at \$60 per foot will cost \$240,000. Through this initiative, stream banks will be planted with native riparian vegetation to directly restore habitat and improve stream bank stability. We will work with the City of Alcoa and the City of Maryville to target sections of Pistol Creek along which the Maryville Blount County Greenway System will be extended. Maintaining healthy plant communities in riparian buffer and upland forest areas is also highly effective to improve soil stability. In terms of physical protection, such communities provide ~~the~~ root structure, soil surface protection, and soil health quality to allow for stormwater infiltration which reduces overland runoff flows and associated soil erosion. This twelve year plan will implement riparian buffer forest habitat enhancement projects to restore and maintain the functionality of these areas in terms of stream protection and health. This initiative will cost \$25,000.

Urban Stormwater BMPs

~~A variety of u~~Urban stormwater BMPs will be implemented to mitigate intense stormwater runoff and transportation of sediment and pollutants. These issues are influenced by ~~a variety~~ landscape, infrastructure, and a wide variety of urban activities. To reduce the volume and velocity of runoff flows during storm events, Blount County Soil Conservation District will develop and implement plans for stormwater retention basins, bioswales, and rain gardens. To address issues of direct stormwater flow to streams, the County will work to remove straight pipes and implement infrastructure retrofits. [Straight pipes are defined here as conduits that transport surface runoff directly from an impervious surface or other pollutant non-point source to Pistol Creek \(or tributary\).](#) The total cost for these initiatives will be \$230,000. In addition to the implementation of urban stormwater BMPs in public spaces, many of these strategies will also be incorporated into and implemented through the Outdoor Environmental Learning Area initiative described hereafter.

Roadside Vegetation Restoration

The restoration and maintenance of healthy plant communities on roadbanks after road construction or development is important for safety, aesthetics, and environmental health. Healthy plant communities along the roadside slow stormwater runoff, filter pollutants, and reduce maintenance needs and costs. ~~The eis initiative -County~~ will target roadside corridors that have unhealthy or non-existent plant communities for vegetation restoration efforts that reestablish plant communities and improve soil health. The cost of this initiative is estimated at \$10,000.

Educational Activities

Outreach & Education Programming

Providing information about the environment and issues with local natural resources is vital to fostering awareness and stewardship in local communities. Blount County Soil Conservation District will lead, support, and engage with several outreach and education programs in Blount County. The 'Blount-Friendly Landscaping' program teaches homeowners about how simple actions, such as mowing no shorter than 3 inches and encouraging more diverse lawn plant communities, can cultivate healthy lawns that increase soil stability, rainwater infiltration, and reduce stormwater runoff to streams. This program also provides information about other simple but highly effective actions homeowners can take to improve local stream health, including pet waste management and the proper disposal of potentially harmful substances such as household chemicals, fertilizers, lawn chemicals, and out of date medicines. Blount-Friendly Landscaping is administered through workshops open to community members and groups such as The University of Tennessee Master Gardeners Association. This program also offers a 'Train the Trainer' workshop to cultivate leaders within the community who can promote environmentally friendly home landscaping practices beyond the County's capacity. Information brochures focusing specifically on pet waste, its impacts on stream health, and management actions will be distributed to pet adoption organizations, veterinarians, and puppy training groups where possible. Blount County Soil Conservation District will also continue to support current initiatives, such as the Little River Watershed Association's "Stream School" program and citizen science efforts. The total cost of all outreach and education initiatives will be \$36,000.

Outdoor Environmental Learning Areas

The Blount County Soil Conservation District is committed to working with Blount County schools to develop Outdoor Environmental Learning Areas (OELAs). OELAs provide an opportunity for teachers and students to incorporate outdoor learning experiences into lesson planning and educational curricula. In addition to being linked with better test scores and improved cognitive skills, outdoor learning increases outdoor exposure for teachers, students, and parents to provide the foundation for a stronger connection to environment and a lasting sense of stewardship for our natural resources. The District will work with five schools to develop ecologically landscaped campus retrofits to create on-campus OELAs that can be used for educational programming. Additionally, each of these school campuses are adjacent to perennial or intermittent blue-line streams. Consequently, campus retrofits will include stormwater BMPs and riparian enhancements that augment other initiatives in the Watershed Management Plan. Finally, students will participate in various aspects of the retrofit implementation

and engage in citizen science monitoring programs. The total cost of this initiative, including both retrofit implementation and educational programming and signage, is \$106,000.

BMP Name	Quantity	Cost/Unit	Budget Estimate
Septic System Improvements	112	\$4,000/system	\$448,000
Agricultural BMPs			
- Livestock Exclusion Fencing	10,000 feet	\$2.75/ft	\$27,500
- Alternative Watering Systems	50	\$2400.00	\$120,000
- Cross-fencing for prescribed grazing	25,000 feet	\$2.75/ft	\$68,750
- Stream Crossings	10	\$3200.00	\$32,000
- Heavy Use Area Feed Pads	20	\$2500.00	\$50,000
- Critical Area Treatment	3 Acres	\$750.00	\$2250.00
- Pasture/Hayland Renovation/Establishment	100 acres	\$200.00/acre	\$20,000
- Animal Trail and Walkway	600 feet	\$7.21/ft	\$4326
- Streambank Restoration	200 feet	\$60.00/ft	\$12,000
- Water Well	5	\$2500.00	\$12,500
- Pumping Plant	5	\$2500.00	\$12,500
- Grade Stabilization Structures	10	\$2000.00	\$20,000
Constructed Wetlands (ag & urban)	3	\$15,000 per wetland	\$45,000
Streambank restoration	4,000	\$60/linear ft	\$240,000
Riparian forest buffer	10	\$2,500/acre	\$25,000
Urban Stormwater BMPs			
- Stormwater retention basin	5	\$8000/site	\$40,000
- Rain garden	5	\$3,000/site	\$15,000
- Bioswale	10	\$3,000/site	\$30,000
- Infrastructure Retrofit	5	\$15,000/retrofit	\$75,000
- Straight Pipe Removal	5	\$14,000/removal	\$70,000
Roadside Vegetation Development	2	\$5,000/acre	\$10,000
School campus retrofits	5	\$100,000/ Campus	\$500,000
Educational Events:			
Homeowner Outreach & Education Workshops	48	\$625/workshop	\$30,000
Pet Waste Outreach Event	12	\$500	\$6,000
Outdoor Environmental Learning Area Ed. Event	12	\$500	\$6,000

Total Budget for Project:	\$ 1,921,826		

Timeline, Tasks, and Assessment of Progress

This management plan is presented in four phases, the first two ~~of which~~ target strategies to reduce pollutant loads and habitat alteration to remove Pistol Creek from the 303(d) list. ~~The~~ Phases three and four will focus on conservation management efforts that provide a foundation to maintain healthy watershed conditions indefinitely.

Phase I: Years 1-3 (Projects outlined for the 319 grant.)

- Implement septic systems improvements for 22 systems on low-income homeowner properties.
- Expand and increase existing Ag BMP implementation.
- Implement urban stormwater BMPs with an emphasis on habitat restoration, straight pipe elimination, infrastructure retrofits, and urban public space retrofits.
- Conduct a watershed-scale assessment for retention basin and bioswale retrofits and installations and generate maps indicating viable locations for implementation.
- Engage in, implement, and advocate for education programs.
- Reevaluate and bolster outreach activities and marketing for conservation management and activities.
- Develop a roadside vegetation plan and implement a section along the Hwy 411 corridor.
- Develop a campus retrofit plan for one Outdoor Environmental Learning Area and begin implementation. Work with at least one school on OELA associated educational programming.

Phase II: Years 4-6

- Assess changes in pollutant loads in Pistol Creek in conjunction with the TDEC 5-year monitoring schedule.
- Develop three year project report for Phase I activities and accomplishments.
- Implement septic systems improvements for 30 systems on low-income homeowner properties.
- Continue Ag BMP implementation, including new marketing and outreach strategies.
- Continue urban stormwater BMPs implementation with an emphasis on habitat restoration, straight pipe elimination, infrastructure retrofits, and urban public space retrofits.
- Implement one retention basin or bioswale installation or retrofit.
- Install one constructed wetland. Assess and develop plans for second site.
- Engage in, implement, and advocate for education and outreach programs.
- Implement roadside vegetation improvements at a new site.

- Implement a campus retrofit plan for one Outdoor Environmental Learning Area and assist with educational programing.

Phase III: Years 7-9

- Assess changes in pollutant loads using data collected under the Blount County monitoring plan for Pistol Creek.
- Develop three year project report for Phase II activities and accomplishments.
- Implement septic systems improvements for 30 systems on low-income homeowner properties.
- Continue Ag BMP implementation, including new marketing and outreach strategies.
- Continue urban stormwater BMPs implementation with an emphasis on habitat restoration, straight pipe elimination, infrastructure retrofits, and urban public space retrofits.
- Implement one retention basin or bioswale installation or retrofit.
- Install one constructed wetland. Assess and develop plans for third site.
- Engage in, implement, and advocate for education and outreach programs.
- Implement roadside vegetation improvements at a new site.
- Complete any remaining tasks for the first Outdoor Environmental Learning Area installation and begin working with a second school to develop a second OELA.

Phase IV: Years 10-12

- Assess changes in pollutant loads in Pistol Creek in conjunction with the TDEC 5-year monitoring schedule.
- Develop three year project report for Phase III activities and accomplishments.
- Implement septic systems improvements for 30 systems on low-income homeowner properties.
- Continue Ag BMP implementation, including new marketing and outreach strategies.
- Continue urban stormwater BMPs implementation with an emphasis on habitat restoration, straight pipe elimination, infrastructure retrofits, and urban public space retrofits.
- Implement one retention basin or bioswale installation or retrofit.
- Install one constructed wetland. Assess and develop plans for future initiatives.
- Engage in, implement, and advocate for education and outreach programs.
- Implement roadside vegetation improvements at a new site.
- Develop a campus retrofit plan for a second Outdoor Environmental Learning Area and begin implementation, including educational programing development.

Criteria to Assess Achievement of Load Reduction Goals

To assess achievement of project goals, water quality data will be assessed in conjunction with the 5-year watershed monitoring cycle as coordinated by TDEC. Additional data and information collected within shorter time frames will be shared with TDEC to supplement planned stream monitoring and assessment. Success will be determined by decreases in pollutant loads and/or the eligibility of the stream to be removed from the 303(d) list.

Activities and management strategies implemented will be documented and assessed in terms of project-specific load reduction value. Further, annual summaries of activities for all types of project initiatives will be used to assess productivity and achievements. Success will be determined by the load reduction value of implemented conservation strategies, measured load reductions at project sites, and the number of other activities (education, outreach, etc.) completed.

Monitoring and Documenting Success

Blount County Soil Conservation District will work with the Knoxville TDEC Division of Water Resources Field Office to ensure that all TDEC sites used for monitoring on Pistol Creek are included in the sites used for the Pistol Creek Watershed Management Plan. Further, full reports prepared for each phase of the management plan (every three years) will be shared with the Knoxville TDEC Field Office. These reports will include data collected and analyzed to monitor *E. coli* and sediment loads in Pistol Creek to monitor changes in pollutant loads and the efficacy of management strategy implementations. Finally, if any annual data collected by Blount County Soil Conservation District indicates that load reductions are sufficient remove Pistol Creek from the 303(d) list for either impairment pollutant, this information will be communicated with the TDEC Field Office immediately for consideration. The follow provides an overview of the monitoring approach for the Pistol Creek Watershed Monitoring Plan.

Every Year:

- 1) Activity summary and assessment of remaining goals for the Phase period. Accomplishments and projects will be listed, assessed for reduction loads, and products will be documented (photos, maps, copies of outreach brochures, etc.)
- 2) Water samples will be collected to measure *E. coli* and sediment loads. This information will be used to affirm and support load reductions provided in annual reports for progress assessment.

- 3) Soils will be collected and analyzed for key aspects of soil quality at sites where habitat is improved in the riparian zone and within the stream

Every 3 Years:

- 1) A term report for each Phase of the management plan will be generated to document the accomplishments and progress during each three year phase period. This report will be detailed and will include impact assessments for the efficacy of management strategies implemented on load reductions.
- 2) Measurement of pollutant loads will be analyzed to determine if Pistol Creek is eligible to be removed from the 303(d) list.
- 3) Water samples will be collected and analyzed for *E. coli* sources to determine if the primary pollutant source has changed. This information will be used to employ an adaptive management strategy that targets the primary source of *E. coli* over time (human, livestock, or pet).

Frequent/Irregular Monitoring Activity:

- 1) Water samples will be collected at various times throughout the year to monitor TSS at times of low, medium, and high flow and at times of major storm events to determine the effects of intense episodic flow.
- 2) Stream height and flow velocity will be monitored at least monthly and during major storm events to determine the effect of management strategies on baseline and pulsed stream flow patterns.